

based the method and time prescribed—the standard of accomplishment. It was found also that they must also be on hand when wanted in order that the workman might not lose time procuring them or be forced to make shift with less suitable or inferior tools. Result: a tool room from which standard tools were provided.

In 1893 Mr. Taylor in his paper entitled "Notes on Belting" made a contribution to the engineering profession of which Mr. Henry T. Towne said in discussing it: "The present paper is modestly entitled 'Notes on Belting,' but could be more fittingly described as a treatise on the practical use of belts. Its thirty-four pages contain more new and useful information than is to be found in any other paper that has come to my knowledge." Here we have a notable example of the establishment and maintenance of standards which determined, for a given set of conditions, the speed, the thickness and width and the tension of leather belts for the transmission of power, and further, the development of a system for their upkeep.

Why Taylor went into it he clearly states as follows: "While working as foreman of a machine shop, the tools of which were frequently driven to their maximum capacity, the writer became convinced that the belts, which were laced according to the ordinary rules, were a great source of loss to the company—not so much from the cost of the belting and the labor of lacing as from the incidental delays to the machines and the diminished output of the shop resulting therefrom. This was particularly emphasized when piece work rates were established requiring the machines to be driven hard and continuously. The belting was then shown to be by far the largest source of trouble in the shop."

It was also found in this early effort to set just piece rates that in order to reach the standard of accomplishment greater attention must be given to having the material to be worked uniform in quality, that a scheme must be provided to insure the worker always having his next job ready, and that the condition of the machines must be kept up to an established standard.

All of this Taylor covers in his paper "A Piece Rate System" by the brief statement:

Not the least of the benefits of elementary rate-fixing are the indirect results.

The careful study of the capabilities of the machines, the analysis of the speeds at which they must run, before differential rates can be fixed which will insure their maximum output, almost invariably result in first indicating and then correcting defects in their design, and in the method of running and caring for them.

But what is more important still, the rate fixing department has shown the necessity of carefully systematizing all the small details in the running of the shop: such as the care of belting, the proper care for cutting tools, and the dressing, grinding and issuing same, oiling machines, issuing orders for work, obtaining accurate labor and material returns, and a host of other minor methods and processes. These details which are usually regarded as of comparatively small importance and many of which are left to the individual judgment of the foreman and workmen are shown by the rate fixing department to be of paramount importance in obtaining the maximum output, and to require the most careful and systematic study and attention in order to insure uniformity and a fair and equal chance for each workman.

While he (the writer) regards the possibilities of these methods as great, he is of the opinion that this system of management will be adopted by but few establishments, in the near future, at least; since its really successful application not only involves a thorough organization, but requires the machinery and tools throughout the place to be kept in such good repair that it will be possible for the workmen each day to produce their maximum output. But few manufacturers will care to go to this trouble until they are forced to.

If Taylor failed to bring out more adequately, in the first published description of elementary time study the importance and absolute necessity for standards, it is not strange that the engineers and managers of that day should have missed the point, but it is astonishing that such a lack of appreciation and understanding should exist today!

Notwithstanding all that has been said and written, relatively few people seem fully to grasp the significance and the importance which reason and experience show should be attached to the subject. Even in shops in which the Taylor System has been applied the management comes to a complete understanding but slowly, as one by one things go wrong owing to imperfectly established standards or more frequently laxity or inadequate methods for their maintenance.

Within the past six months I have been consulted by several managers who sought through the establishment of some sort of a pay system a cure for their industrial ills, but who shied off when I explained to them what a real remedy involved. Quite recently in a very large plant I had the pleasure of attending a meeting of the "rate setters" from every department. In this plant they had slowly progressed through the stages of setting rates for piece work, premium work and contract jobs, based upon old records, the judgment or opinion of foremen or plain guess, to those based upon some sort of analysis or study, and in a limited degree had arrived at setting rates based on elementary time study. Just where Taylor was between 1885 and 1890! It was interesting to hear these men describe the difficulties they were contending with and trying to overcome; all due to lack of standards. The same old story of trouble with belts, tools, machines, materials, inadequate planning and lack of

control. If left to themselves these men would perhaps ultimately and in somewhat less time reach the same point to which the Taylor System has developed today; but what a waste of time and energy, going over the same ground that Taylor went over, when they might profit by his experience!

*A successful installation of scientific management calls for the establishment of standards; its continued successful operation calls for their maintenance.*

There is, of course, nothing permanent about standards; they must be modified, discarded and replaced to keep pace with progress and change; but the fact that under a system of scientific management changes may not be made without full knowledge of all that they entail is a fine safeguard against their being instigated unwisely. Taylor frequently called attention to the folly and danger of making what he picturesquely but forcefully designated as "damned improvements." In this category he placed those changes or innovations which impulsive people are wont to make without due investigation and consideration, or in some cases simply to satisfy a desire for something new, and as a result of which many businesses are kept in a constant turmoil. The installation of scientific management is, as only those of you who have gone through it can fully realize, of necessity a long and arduous undertaking, calling not only for knowledge and experience but for infinite patience and confidence. Owing to the multiplicity of factors upon which success in the undertaking depends, not the least of which is the human factor, each feature of the system as installed may be expected to break down several times before it finally works smoothly. At such times there is a strong impulse to assume that the trouble may be corrected by making changes in the plan. The engineer directing the installation must be on his guard against changes, which in themselves may be harmless so far as the feature of the system directly affected is concerned, but which may fail to fit in with other features whose development may not be taken up until some later time. Each change of this character encourages others and may result in the complete failure of the undertaking, or what is almost as bad, in a mongrel system affording little satisfaction to anyone and which sooner or later may bring discredit to the scientific management movement. In this matter to follow the path of least resistance is almost always to court trouble.

After the system has been properly installed it is not so easy to make "damned improvements" or to lightly depart from standards, yet that must be

guarded against, particularly by those high in authority who unfortunately cannot be expected to have a knowledge of all the details of the system, their relationship and interdependence. The motive for making such changes usually lies in a desire to correct a trouble resulting from some standard having been imperfectly established or maintained.

Most of the injustice with which ordinary piece work has been charged may be traced to lack of standards. We must be on our guard against further injustice. There are today managers who are unwilling to go to the expense or to undertake the work that is involved in the establishment and maintenance of standards essential to a true application of the principles of scientific management; they crave the benefits of increased production and delude themselves that they can get them by taking a short cut. These misguided individuals mistake the form for the substance just as did those who in 1896 discussed Taylor's piece work paper, and think that by merely making time studies—"frequently unworthy of the name"—and setting tasks they will get to the ultimate object directly. Alas, it won't work!

Several years ago a large establishment in Europe started, under the direction of an able engineer, to install the Taylor System. In one department it was well done, conditions were properly standardized and maintained, the work was routed and well controlled, proper tools and instructions were provided, and tasks were set justly on a basis of good elementary time study. Everything was going well in this department; so well in fact that the owner became impatient to see similar results in all other departments. He demanded that the workmen in another department be put on task and bonus, a certain number per day, faster than standard conditions could be established. The engineer in charge protested and left when the owner insisted. Nevertheless, the owner's orders were obeyed and a long and bitter strike resulted. In reality the men struck not against the system but for it. They said; "We can't make these rates; in the other department where you installed this system you have fixed up the machines and the belts and have men to keep them in repair; you deliver the tools—which are better than ours—to the machine in advance for each job; you have the material placed conveniently to the machine so that no time is lost between jobs. In that department the time can be made and the men earn their bonus. We have to take care of our own machines and belts, hunt up and grind our own tools and hunt up our own jobs. We demand that you do in our department what you did in the other department."